

Appl. No. 09/836,464
 Reply to Final Official Action mailed on 04/16/2004

The listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claims 1-3 (cancelled)

Claim 4 (Currently amended) A quantum well infrared photodetector ~~according to claim 3~~ wherein the comprising:

a plurality of doped quantum well layers forming a multi-quantum well structure,
each doped quantum well layer having a doping density that is selected to be sufficiently
large for providing high absorption during near room temperature operation; and,
contact layers for receiving current from the plurality of doped quantum well
layers, wherein the plurality of doped quantum well layers includes more than 10 doped
quantum well layers.

Claim 5 (currently amended) A quantum well infrared photodetector according to claim 4 wherein ~~the~~ a doping density (Nd) of the doped quantum well layers is given by

$$Nd = (m/\pi\hbar^2)(2k_B T),$$
 where m is the effective mass, h is the Planck constant, k_B is the Boltzmann constant, and T is the desired operating temperature in degrees K Kelvins.

Claim 6 (currently amended) A quantum well infrared photodetector according to claim 5 wherein the multi-quantum well structure includes a plurality of barrier layers alternating
with the doped quantum well layers, the doped quantum well layer material comprising is
GaAs, the barrier layer material comprising is Al GaAs, and the operating temperature is
room temperature, the dopant species comprising Si, and Nd being is in the range of 1 -
2E12 cm⁻².

Claim 7 (original) A quantum well infrared photodetector according to claim 6 wherein the contact layers are formed of GaAs doped with Si to a concentration of 1E17 to 5E18 cm⁻³.

Appl. No. 09/836,464
Reply to Final Official Action mailed on 04/16/2004

Claim 8 (cancelled)

Claim 9 (currently amended) A quantum well infrared photodetector comprising:
a plurality of quantum well layers formed of a first semiconductor material and doped forming a multi-quantum well structure for providing high absorption at temperatures other than low temperatures and substantial dark current;
barriers between the quantum well layers formed of a second semiconductor material; and,
contact layers comprising a third doped semiconductor material,
wherein the dopant for doping the first semiconductor material has a dopant concentration that is selected to be sufficiently large for providing high absorption during near room temperature operation.

Claim 10 (original) A quantum well infrared photodetector according to claim 9 wherein temperatures other than low temperatures include temperatures at or near room temperature.

Claim 11 (original) A quantum well infrared photodetector according to claim 10 wherein the first semiconductor material is GaAs.

Claim 12 (original) A quantum well infrared photodetector according to claim 11 wherein the dopant for doping the first semiconductor material is Si.

Claim 13 (original) A quantum well infrared photodetector according to claim 12 wherein dopant concentration of the Si is approximately $1 - 2 \times 10^{12} \text{ cm}^{-2}$.

Claim 14 (original) A quantum well infrared photodetector according to claim 13 wherein second semiconductor material is Al GaAs.

Claim 15 (original) A quantum well infrared photodetector according to claim 14 wherein fraction of Al is from 10%-50%.

Appl. No. 09/836,464
Reply to Final Official Action mailed on 04/16/2004

Claim 16 (original) A quantum well infrared photodetector according to claim 15 wherein the third doped semiconductor material is GaAs doped with Si.

Claim 17 (original) A quantum well infrared photodetector according to claim 16 wherein the third doped semiconductor material is doped with Si to a concentration of $1\text{E}17$ to $5\text{E}18\text{ cm}^{-3}$.

Claim 18 (original) A quantum well infrared photodetector according to claim 17 wherein the third doped semiconductor material of a thickness within a range of $0.1\text{-}2\text{ }\mu\text{m}$.

Claim 19 (currently amended) A quantum well infrared photodetector according to claim ~~[[8]]~~ 18 wherein the plurality of doped quantum well layers is designed for operation at frequencies above 1 GHz.

Claim 20 (previously presented) A quantum well infrared photodetector according to claim 19 wherein the plurality of doped quantum well layers is designed for operation at frequencies above 30 GHz.

Claim 21 (currently amended) A method of detecting infrared radiation comprising the steps of:

utilizing the quantum well infrared photodetector of claim 4, detecting infrared radiation ~~with a quantum well device~~ absent cryogenic cooling; and, determining an intensity of the detected infrared radiation.

Claim 22 (previously presented) A method of detecting infrared radiation according to claim 21 wherein the step of determining comprises the step of:

filtering the dark current component of the detected signal to determine an intensity of the detected infrared radiation.

Appl. No. 09/836,464
Reply to Final Official Action mailed on 04/16/2004

Claim 23 (previously presented) A method of detecting infrared radiation according to claim 21 wherein the step of detecting is performed at or near room temperature.

Claim 24 (new) A quantum well infrared photodetector comprising:

a plurality of doped quantum well layers formed of GaAs doped with Si, a doping density of each doped quantum well layer of the plurality of doped quantum well layers being in the range of $1 \times 10^{12} \text{ cm}^{-2}$ to $2 \times 10^{12} \text{ cm}^{-2}$;

a plurality of barrier layers formed of Al GaAs, the barrier layers alternating with the quantum well layers so as to form a multi-quantum well structure for providing high absorption at temperatures other than low temperatures; and,

contact layers for receiving current from the plurality of quantum well layers.